UNIVERSITY OF CALIFORNIA.

AGRICULTURAL EXPERIMENT STATION.

BULLETIN NO. 30

Concerning Specimens Sent for Examination.

Many samples of various kinds, forwarded to the Agricultural Department for examination, come unaccompanied by any mark or label by which they can at once be identified with those alluded to in letters sent by mail. Sometimes such packages remain untouched for months for want of such identification, and at all times a great deal of unnecessary trouble results from the omission to place full labels with soil bags, etc.

It is specially requested that every sample sent, of whatever kind, should be fully marked, at least with the name of the locality and sender, besides such numbers or letters as may be placed upon it for reference; and that the express tag should, in every case, bear the name and address of the consignor, in the blank provided for the purpose.

Examinations of Various Upland Soils.

No. 788.—*Red subsoil from the foothills near Ione, Amador County*; sent in by Thos. S. Crafts, of Ione, with request for an opinion as to fitness for fruit culture. The samples sent were the soils and sub-soils of two kinds of land—the red soil of the higher lands, and the light, chocolate-tinted loam of the valleys. Only the subsoil of the first has thus far been analyzed, and suffices to show the general character of the lands. The surface soil of the red land to the depth of 12 to 13 inches, is relatively light, so that dry lumps can be readily crushed between the fingers—an easily-tilled loam. The subsoil, 13 to 25 inches, is a good deal heavier; the lump not to be crushed between the fingers, and quite adhesive when wetted. This subsoil varies in thickness; from a depth ranging from about 33 to 55 inches the red color changes to a yellowish tint; then immediately upon the bedrock, which lies at variable depths, the color is bluish. The bedrock is slate traversed by ledges of "round, very heavy rock."—Ninety-five per cent of the subsoil passes the sieve of 1-50-inch meshes, and the analysis of the fine earth gave the following result:

RED SUBSOIL, IONE.

Insoluble Matter	48.98	67.67
Soluble Silica	18.70	
Potash		.22
Soda		.10
Lime		2.77
Magnesia		1.80
Br. Oxide of Manganese		.09
Peroxide of Iron		7.91
Alumina		14.98
Phosphoric Acid		.04
Sulphuric Acid		.06
Water and Organic Matter		4.11
Total		99.76
Humus in Surface Soil		6.07
Available Inorganic		5.67
Hygroscop. Moisture		7.09
Absorbed at	10.5° C.	

The percentages of potash and phosphoric acid in this subsoil are quite low for California, the latter ingredient being rather deficient. Doubtless the analysis of the surface soil would have given higher percentages of both; but the high figure for lime offsets in a measure the defect, in rendering the other ingredients active. While the soil would not endure long without fertilizers under grain culture, it is certainly well adapted for fruit, and whenever production shall become stinted, phosphate fertilizers will first be needed. High quality rather than quantity is to be expected from this land.

The chocolate-colored valley soil is doubtless richer in plant food, and would probably answer excellently well for apricots and pears, while the red land is more especially adapted to vines, almonds, peaches and olives.

No. 643.—*Black waxy adobe*, from the Colton ranch, at the foot of Mt. Diablo, on the Alamo road. This is an adobe soil of the most extreme characters thus far met with. It bears a growth of fine white oaks, in rare places large sunflowers, but little or no grass. When dry it is of a dark slate color, and of stony hardness. When wet it is as adhesive as birdlime, and vehicles running on it soon have their tires thickly covered with a firmly adhering, uneven ring of adobe, which must be from time to time removed by means of a cutting tool, in order to ease the team and occupants. Like the other adobe soils, it "slakes" quickly on wetting the stony, hard dry lumps; but it is difficult to find any condition of moisture at which it is easily tillable. It is free from all coarse

particles, all passing through a sieve having meshes of 1-50 of an inch. The mechanical analysis gave the following result:

No. 643—Black Waxy Adobe.

Fine Earth	All

Mechanical Analysis of Fine Earth.

Clay		43.54
Sediment of	<0.25 mm. hydraulic value	34.05
" "	0.25 mm	1.59
" "	0.5 mm	2.59
" "	1.0 mm	3.13
" "	2.0 mm	2.79
" "	4.0 mm	2.26
" "	8.0 mm	1.76
" "	16.0 mm	.75
" "	32.0 mm	2.23
" "	64.0 mm	
Total		94.68

Few tillable soils thus far analyzed show a higher clay percentage than this, which is not unlike the "buckshot soil" of the Mississippi bottom, in the proportion of its finest ingredients; but differs in that in the latter there is a gradual, regular "tapering-off" from the finest toward the coarsest, while in the California soil there is one of those sudden breaks in the percentages, which seems in all cases to imply heaviness in tillage. The chemical analysis resulted thus:

No. 643—Chemical Analysis.

Insoluble Matter	50.96	59.98
Soluble Silica	9.02	
Potash		.19
Soda		.74
Lime		2.47
Magnesia		.89
Br. Oxide of Manganese		.07
Peroxide of Iron		11.09
Alumina		15.69
Phosphoric Acid		.06
Sulphuric Acid		.05
Carbonic Acid		Trace
Water and Organic Matter		8.30
Total		99.52
Humus		1.50
Available Inorganic		.83
Hygroscop. Moisture		13.5
Absorbed at	13.5° C.	

The remarkably small percentage of potash, and the high one of soda shown in this analysis led to a repetition of the determination, but with a similar result. The phosphoric acid likewise is in small supply, while the amount of lime (two and one-half per cent) is high, and should render the soil susceptible of better tillage than it seems to attain in ordinary practice, especially as the humus supply is quite large. But of all adobe soils thus far examined, this is the poorest in potash and phosphates, and therefore the least durable in cultivation. The black adobe soils of the San Ramon valley proper, however, differ materially in aspect from this, and are doubtless richer in plant food.

Nos. 708 and 709.—*Bench and mesa soils*, from the Zaca ranch, between the Santa Inez and Santa Maria rivers, Santa Barbara county. Sent by Mr. Oscar Steinbach, of San Francisco. This tract is understood to be mainly mesa land lying between the two main streams, and intersected more or less by small creeks, running dry in summer, but sometimes carrying considerable volume in winter, and whose narrow bottoms are largely quite sandy and stony. The slope lands bear a growth of scattering live and white oaks, with alfilerilla, bunch grass, wild oats, etc. On the mesa proper, about 100 feet above the drainage, the tree growth is more scattering, but otherwise the vegetation is the same as on the slope or bench lands. There is little difference between the soil and subsoil for two feet, or even more.

No. 708 was taken from the westward valley slope, about 50 feet above the level of the creek

bed, to 12 inches depth it is full of rock fragments and gravel, which forms 38 per cent of its mass. The fine earth passing through 1-50 inch meshes, is of dark-mouse color, rather blackish—a sandy loam. At 42 inches the color changes to a lighter hue, but the subsoil continues the same for several feet.

No. 718 was taken from the mesa about 100 feet above the creek bed; dark mouse-colored loam, with much gravel and some rock fragments, to the extent of 47.6 per cent. The fine earth is a sandy loam, like 708, only somewhat lighter colored. The analyses resulted as follows:

Soils from Zaca Rancho.

	708. Bench Soil.		718. Mesa Soil.	
Insoluble Matter	73.94	85.44	82.95	87.61
Soluble Silica	11.50		4.66	
Potash	.56		.49	
Soda	.31		.81	
Lime	.90		.72	
Magnesia	.73		.52	
Br. Ox. of Man'ese	.07		.05	
Peroxide of Iron	3.34		3.59	
Alumina	4.03		2.46	
Phosphoric Acid	.14		.13	
Sulphuric Acid	.01		.02	
Water and Or. Mat.	4.51		4.36	
Total	100.04		100.76	
Humus	1.29		1.77	
Avail. Inorganic	.81		.49	
Hygro. Moisture	8.21		3.26	
Absorbed at	14° C.		16° C.	

There are no wide differences between these soils, save such as would be expected from the difference in location and the greater degree of moisture naturally prevailing in the bench land as compared with the mesa. Both have ample supplies of all the ingredients of plant food—potash, lime, phosphoric acid, and humus as representing the supply of nitrogen, and should yield excellent returns under good cultivation and with sufficient moisture. As they are somewhat open they require deep tillage to enable the roots to penetrate readily through the gravelly subsoil, which, however, seems quite loose and vervious. In view of the climate and the inadequacy of water for irrigation, vine and fruit culture, but especially that of the olive, seems indicated as their most profitable use.

Soil and Subsoil from Pomona Colony, Los Angeles County. Collected by Mr. N. J. Willsen from Mr. House's place, three-quarters of a mile north 10° west from Pomona R. R. station. The soil and subsoil scarcely differs in appearance down to 32 inches depth, and constitute a reddish-gray, rather sandy loam, easily tilled. Natural vegetation, alfilerilla, clover malva and rattleweed (Astragalus Sp.), produces about 25 bushels of wheat and ten tons of alfalfa per acre when irrigated, and is well adapted to fruits and cereals. The soil was taken to the depth of 12, the subsoil from that of 12 to 32 inches.

Soil and Subsoil from Pomona.

Insoluble Matter	72.52	77.64	75.30	79.17
Soluble Silica	5.12		3.87	
Potash	.84		.96	
Soda	.30		.30	
Lime	2.35		2.05	
Magnesia	2.23		2.15	
Br. Ox. of Man'ese	.04		.04	
Peroxide of Iron	8.10		7.34	
Alumina	5.97		5.84	
Phosphoric Acid	.02		.05	
Sulphuric Acid	.02		.02	
Water and Or. Mat.	2.55		2.55	
Total	100.05		100.48	
Humus	.32			
Avail. Inorganic	.26			
Hygro. Moisture	3.26		2.37	
Absorbed at	11° C.			

This soil, judging from the great similarity of appearance, may be taken as representing a large area of similar lands in the San Bernardino valley. The soil and subsoil differ but very slightly in composition. Both have a large supply of potash and lime, as well as magnesia, and in both the phosphoric acid is low; in the soil quite deficient, but apparently increasing with the depth. The supply of humus is very small, and its increase by green-manuring would seem to be among the first needs suggested by the analysis. It must not be forgotten, however, that in these dry regions the surface soil is often of less importance than the subsoil, within which the roots must remain in order to be secure from heat and drouth. Evidently such soil, while at first capable of high yields, will soon need phosphate fertilizers for the continued production of shallow-rooted crops at least; while alfalfa, vines and other deep-rooted plants, will be able to draw upon the deep subsoil for their supply of that ingredient for a long time to come.